WASHINGTON
SCIENCE TRENDS

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* NAVY ELECTRONICS PROGRAMS

✓ Project Mailbuoy -- The Navy awarded its first major contract this week in a unique program to determine the feasibility of using existing installed fleet equipment for satellite readout applications. The project is known as "Mailbuoy" and has been assigned to the Navy Electronics Laboratory, San Diego, Calif.

Officials explain that most space projects start with the satellite and launching vehicle, and that electronic ground support equipment must be specifically designed to be compatible with satellite output. Mailbuoy's major purpose is to explore the possibilities of utilizing an estimated $50 million of UHF equipment already on-board Navy ships -- "to ensure that expensive replacements for use with satellites are developed only when necessary." A supporting contract of approximately $197,000 went to Aeronutronic Division of Ford Motor Company.

✓ Communications Moon Relay -- Modifications are now planned for the Communications Moon Relay System (CMR) developed by the Navy's Bureau of Ships. The Naval Research Laboratory, Washington, D. C. provides scientific direction for the project, and the Development Engineering Corporation has been systems contractor.

A review of the program by Capt. Edward J. Fahy, USN, points out that the system has been regularly utilized in the transmission of radioteletype, short wave, voice and facsimile traffic. Transmitting locations at Opana, Hawaii, and Annapolis, Md. and receiving stations at Wahiawa, Hawaii and Cheltenham, Md. are operational from four to ten hours daily -- from Moonrise in Hawaii to Moonset in Md.

A number of times in recent months normal MF/HF traffic between the mid-Pacific and the U. S. East Coast was completely closed down due to severe ionospheric disturbances, so that CMR served as the only operational radio link between the areas served.

In addition, the system has also served as a valuable scientific research tool for studies on modulation techniques, antenna characteristics, terminal instrumentation and general studies on the nature of propagation of radio energy through space and the ionosphere.

Modifications are planned for the CMR terminals, and experiments will be undertaken with new terminal equipments and techniques "to provide even more information in the newly important microwave frequency region and on more sophisticated modulation techniques."

Officials express hope that these improvements will allow the Navy to communicate via satellites developed by the civilian space agency, NASA, such as Echo and Rebound, and the active satellites being developed by NASA and other Government agencies. This effort includes study of shipboard installations for operational space communications systems under Project Mailbuoy.

* AEC TO PROVIDE GREATER ACCESS TO CLASSIFIED FILES

Private industry will be permitted access to classified information in additional key areas of nuclear reactor development, under new regulations adopted this past week. Security safeguards must first be met before the material, in AEC files, may be studied.

The new areas are:

✓ Nuclear Reactors for Ramjet Propulsion -- Includes technical information on the theory, design, engineering, thermodynamics and nuclear experience necessary for the development of a nuclear reactor for a ram-jet reactor propulsion system. Information on non-reactor aspects is excluded.

✓ Nuclear Reactors for Rocket Propulsion -- Includes technical information on the theory and engineering developments of fuel materials for high power density, light-weight reactors and related nuclear technology for the propulsion of space vehicles. Information on non-reactor aspects of engine systems is excluded.

✓ Advanced Concepts for Future Applications -- Includes technical information on components, materials and physics for such projects as a lithium-cooled reactor and other advanced reactor concepts. Information related to specific requirements of other Government agencies is excluded.

✓ Systems for Nuclear Auxiliary Power -- Includes technical information on theory, design, research and development, fabrication, test procedures and power conversion of isotope and reactor power systems. Information on advanced concepts is not included in this category.

These areas are to be opened to industry under the AEC's long-standing Access Permit program in which applicants, after appropriate authorization and security safeguards, may obtain access to restricted data which is of value for private business and research uses of atomic energy. These persons must meet all AEC's requirements for protecting classified information.

In addition an organization desiring access to classified data in these fields must establish that it is qualified to make a contribution to r&d in such fields, or that it is preparing an r&d proposal for the AEC in such fields, or that it is furnishing substantial professional assistance to an access permit holder.

(For further information contact Director, Division of Industrial Participation, Atomic Energy Commission, Washington 25, D. C.)

* VIBRATION ISOLATION SYSTEM

The Sandia Corp. operating for the Atomic Energy Commission, has designed a unique vibration isolation system for its standard laboratory. The design is said to be adequate for the purpose intended, and to be readily adaptable to other applications.

Other attempts to solve critical vibration problems in various laboratories have proved costly or complicated. Some laboratories built piers of reinforced concrete which were then sunk 40 to 60 feet into the ground, completely isolating them from the building. This proved satisfactory except when seismic disturbances occurred. In another attempt, the Mound Laboratory, Miamisburg, Ohio built an unusual mechanical spring system using dash pots. The National Bureau of Standards devised an ingenious system using inner tubes.

Sandia Corp. required a small and relatively inexpensive system for isolating shock and vibration affecting light-beam galvanometers, which could be carried by two men and could be mounted on ordinary work benches. The solution was a system which took the form of a 1-inch thick aluminum plate placed upon four blocks of polyurethane foam. Details of construction are now available.

(For further information see Report SCR-283 available through AEC channels or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

* ARMY RESEARCH PROBLEMS (Continued from WST, December 4, 1961)

□ QMC - 167 -- Study the absorption, transformation, and utilization of energy. (Suggested means of utilizing solar energy include the use of both living and non-living systems, based on a photochemical energy-absorbing organism, such as the Chlorella algae, on the absorption and storage of energy by a synthetic chemical system or by physical means such as the thermocouple or solar storage batteries (yet to be constructed). A great deal of fundamental work must be done before these systems can be considered practical. Thousands of organisms must be screened, their efficiency determined, and their effect of various types of radiation encountered in deep space, must be studied. No adequate chemical system for absorbing and storing energy has been devised, despite the close examination of numerous systems. One which has not received the attention it deserves involves certain classes of dyes which are photochemically receptive.

An understanding of the complex reactions whereby chlorophyll acts as an intermediate or agent in the transformation of energy might well provide the answer to the problem. Since free radicals are probably involved in these reactions, studies should be made of energy-rich excited states of atoms, molecules, and related species, including the mechanism of their formation, the influence of the medium and temperature upon their lifetimes, mechanism of energy transfer processes, etc. Single photoconductive cells have been developed with efficiencies of 10% or better, but there is a need for higher efficiencies and a method for making reproducible cells. Whatever system is used, there is the requirement for an energy absorbent which will absorb throughout the entire solar spectrum. Problems awaiting solution include the study of the effect of concentrated solar energy on receiving surfaces, resistance of materials to high temperatures (short pulses and equilibrium conditions), the use of concentrated solar energy for the production of substances such as single crystals and for the purification of materials. More knowledge is needed on solar radiation itself, such as its pressure and polarization characteristics.)

□ QMC - 168 -- Develop equipment for converting heat energy into electrical energy. (1. Existing approaches to the solution of the problem: Work has been done in the past on the development of thermoelectric units consisting of chromel-constantine couples and employing conventional pressure type gas burners. 2. Inadequacies or defects: The equipment thus far developed has had main defects in the burning equipment in that the mechanism would foul up and would not burn properly. The overall efficiency of the system has been less than 1/2 of 1%, thus making these units quite uneconomical in their operation. 3. Pertinent Military Characteristics: Equipment for converting heat energy into electrical energy should have efficient and fool-proof heating and heat transfer mechanism; should be capable of using several types of fuel, such as gasoline, diesel oil, kerosene, alcohol, etc.; should have a minimum size and weight commensurate with output of the equipment; should be capable of operation from -65° F. to +165° F.; should require minimum attention after being put into operation; should have no moving parts, if possible; should be portable; thermocouples should be of such construction and composition as to provide efficiency above 5 or 10%, if possible; equipment should have good voltage regulation and should have reasonably constant power output during variation of temperature.)

□ QMC - 170 -- Devise techniques for vulcanizing, compounding, and processing new elastomers, which do not respond to conventional methods. (New rubber materials are continuously being developed by governmental agencies and by industry. Many of these rubbers do not lend themselves to conventional methods of vulcanizing, compounding, and processing; hence, new systems are needed. These materials include fluorine-containing organo-metallic, modified silicone, and urethane rubbers.)

* ARMY RESEARCH PROBLEMS (Continued)

- QMC - 169 -- Devise methods for determining the basic structural configurations and the physical and chemical characteristics of high polymers under extreme conditions. (Although considerable information has been accumulated for any given synthetic high polymer, insufficient basic data exist which can be used to predict the behavior of a possible polymer not yet synthesized. For example, it is not yet known how many fluorine atoms and their location in the fluoropolymer molecule contribute to a polymer's resistance to high temperatures. The requirement exists for more knowledge regarding the new preparative techniques which give rise to stereochemical configurations. Once prepared, there is the further need that the structures be correlated with such chemical, physical, and mechanical properties as the molecular weight range, X-ray diffraction pattern, solution properties, resistance to ionizing radiation, stress relaxation, their spectroscopic fingerprints, the interaction of the polymer molecule with other molecules and a host of other properties. The examination of the tailored polymers should include the collection of basic data on their behavior under extreme conditions of space travel such as their strength under high-speed loading, and the stresses and strains resulting from great temperature fluctuations. Successful solution of these problems will greatly aid the development of more suitable materials for aerial drop, ballistic armor, containers, and others, with satisfactory resistance to corrosive rocket propellants and extreme temperature fluctuations.)

- QMC - 173 -- Develop new gasoline-resistant rubber formulations which have tensile strengths of 2,000 p.s.i. of greater, and which will maintain their true rubbery properties over the temperature range of -65° to 160° F. (Silicone compounds with low tensile strength and elongation are available as a result of research studies during the last few years. Considerable research has been done on butadiene type polymers and several satisfactory elastomers have been developed for general purpose use. Oil-resistant polymers present an unusually difficult problem in that, in general, the polarity of the molecule, necessary for oil resistance, contributes to poor low temperature resistance. The fields of fluorocarbons, polyurethanes, etc., are under investigation to develop fuel and chemical-resistant Arctic rubbers.)

- QMC - 171 -- Develop elastomers which retain their properties at high temperatures and in contact with a variety of chemicals. (Presently available elastomers become soft and gummy at high temperatures and lose their elastomeric properties. Applications of elastomers for gaskets and hoses which require service at high temperatures in contact with hydraulic fluids and other chemicals, cannot be made with available elastomers. New materials are needed which will meet these very unusual requirements.)

- QMC - 174 -- Develop a high temperature range plastic or elastomer. (There is a need for a plastic or elastomer for use at operating temperatures from -90° F. to +550° F. or higher to 700° F., being stable and resilient to the same order as hydraulic O-ring seal compound to Specification MIL-P-5516, Class B at -65° F. to +160° F. For use in hydraulic and pneumatic system seals and gaskets at operating temperatures between -90° F. and over 550° F.)

- QMC - 178 -- Develop new lightweight materials. (Techniques are needed for applying basic principles involved in mechanical energy conversion to development of fiber types, fabric structures, and fabric systems to meet the full range of lightweight, functionally superior, military items of combat clothing, parachutes, aerial delivery webbings, and personnel armor. Work is being done to develop knowledge of the mechanisms involved in attenuation of mechanical energy covering the range from 10^{1} to 10^{6} percent per second. Additional knowledge is needed concerning the behavior of textile fibers when subjected to relatively low rates of strain as well as rates falling between those to which conventional parachutes are subjected and those involved in ballistic operations. These are particularly important because of the necessity for developing high speed aerial delivery systems, which involve greater rates of strain than current methods.)

* ARMY RESEARCH PROBLEMS (Continued)

□ QMC - 179 -- Develop batteries that can withstand extended storage. (Special treatment of lead-acid industrial storage batteries in the manufacturing process is needed to permit storage in a dry-charged condition up to ten years under normal warehouse conditions. At the end of ten years, batteries should deliver maximum performance and possess normal operational life upon placement in use.)

□ QMC - 180 -- Devise a simple, effective method of non-destructive inspection of vacuum-insulated containers. (At the present time it is necessary to subject these items to simulated field conditions, which is time-consuming and costly. Techniques are needed for inspecting vacuum-insulated containers (1) after fabrication of items, and (2) after items have been in storage for extended periods of time, to assure that the vacuum level within the container is adequate, prior to issue to troops in the field.)

(To be continued)

* TWO MAN CAPSULE TO TEST SPACECRAFT RENDEZVOUS

McDonnell Aircraft Corp. will build for the National Aeronautics and Space Administration a dozen two-man Mercury-type space capsules capable of docking with another vehicle in an Earth orbit. The new craft will be slightly larger and weigh two to three times as much as the one-man Mercury capsule and will be boosted into orbit by modified Titan II intercontinental ballistic missiles built by the Martin Marietta Corp. The rendezvous target vehicle will be an Agena stage produced by Lockheed Aircraft Corp. which will be launched into Earth orbit by an Atlas ICBM.

NASA says that once the Agena is launched, ground tracking stations will determine the optimum launch time for the Titan-boosted spacecraft. When both vehicles are in orbit, propulsion in both the Agena and two-man spacecraft can be used to perform rendezvous and docking maneuvers.

✓ Two Approaches -- As previously reported, NASA officials are greatly interested in the possibility of using orbital rendezvous techniques for carrying out a step-by-step manned lunar landing mission. Another possibility is the direct-flight approach using a huge, multi-million-pound thrust Nova booster. NASA officials state that "Both methods will be explored in order to meet a national goal of a manned lunar landing by 1970."

✓ Time Schedule -- Two man flights would begin in the 1963-4 time period, starting with several unmanned ballistic flights from Cape Canaveral, Fla. These will be followed by several manned orbital flights and eventually by rendezvous "fly-bys" and actual docking missions. NASA's current seven astronauts will serve as pilots in the program, with the expectation that additional crew members may be phased in during the later stages of the flight program. In addition to experimentation with manned rendezvous techniques, the two man craft -- with its capability of Earth orbital flights of a week or more -- will provide training for future long-duration circumlunar and lunar landing flights.

✓ Costs -- The "preliminary" cost estimate for the rendezvous test program is in the neighborhood of $500 million -- including the spacecraft and the launching vehicles. The project expects to make use of many proven Mercury spacecraft systems. Expanding the 74-inch base of the current Mercury capsule by one foot and lengthening the capsule proportionally will provide 50 percent more cabin space needed to carry out the new craft's missions.

TECHNICAL TRENDS

□ The U. S. Bureau of Mines has issued its first comprehensive report on Lithium, a mineral almost unknown two decades ago and now the basis of a multi-million dollar industry. Copies of Information Circular No. 8053 - Lithium are now available at 50 cents each from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. √√√ Field tests have demonstrated that the use of airplanes to spray chemical films on large storage reservoirs can be an economical and effective way of reducing water evaporation losses. Details are available in Announcement P.N. 103918-61 issued by the Information Office, U. S. Department of the Interior, Washington 25, D. C. √√√ Organizations interested in microfilm files of U. S. Government Research Report Catalogs may obtain further information on price and availability from the Chief, Photoduplication Section, Washington 25, D. C. √√√ Information on a conference on radioisotopes in industry scheduled for January 11-12, 1962 at Baton Rouge, La. is available from H. D. Richardson, Nuclear Science Center, Louisiana State University, University Station, Baton Rouge 3, La.

□ The National Science Foundation has confirmed recent grants totalling $4,161,500 in a new program for establishing and improving low energy nuclear physics research facilities at various universities. The funds are being used for Van de Graff accelerators and cyclotrons, and the program is detailed in Announcement NSF-61-157 available from the Information Office, National Science Foundation, Washington 25, D. C. √√√ Information on a Navy-Sponsored Conference on "Self-Organizing Systems" to be held in Chicago during May, 1962 is now available from G. T. Jacobi, COSOS Conference Secretary, Armour Research Foundation, 10 West 35th St., Chicago 16, Ill. √√√ The Atomic Energy Commission has eased its regulations governing the use of depleted uranium as counterweights in the wing tips and tail pieces of commercial jet aircraft. The material costs less, and has a higher density than sintered tungsten, normally used for such purposes. √√√ The National Bureau of Standards, Office of Technical Information, Washington 25, D. C. can supply details on "Improved Rectifier Circuits" which are expected to provide superior regulation and filtering in certain single-phase rectifiers and may be particularly valuable in electronic instrumentation. √√√ Information on Symposium on Standards for Filament-Wound Reinforced Plastics to be held in the Washington, D. C. area during June, 1962 is now available from H. A. Perry, Naval Ordance Laboratory, White Oak, Silver Spring, Md.

□ The Information Office, U. S. Atomic Energy Commission, has available a limited supply of Announcement D-319 detailing grants to 106 educational institutions for the purchase of laboratory equipment and the fabrication of neutron sources. √√√ A presentation on NASA Aeronautical Research by George P. Bates, Jr. of the National Aeronautics and Space Administration is available as Release No. 238 from the Public Information Office, NASA, Washington 25, D. C. √√√ The Contracting Officer, Naval Ordnance Laboratory, White Oak, Silver Spring, Md. is looking for firms active in the field of low power underwater acoustic devices which employ new data processing techniques for use at low signal to noise levels. √√√ General Electric Co. will soon offer commercially three new types of traveling-wave tubes with power outputs up to 1 kilowatt in the K_u band, originally developed under an Air Force contract. The tubes are being built at GE's Palo Alto, Calif. facility.

□ Aerojet-General Corp., Aetron Division, will build the $8 million stand for testing of the NERVA nuclear rocket propulsion engine at Jackass Flats, Nev. The contract includes superstructure, liquid hydrogen storage, data acquisition facilities and neutron shielding. A high efficiency steam ejector will be used to simulate altitudes of more than 80,000 feet. √√√ Sperry Gyroscope Co. believes there are "strong indications" that its hydrogen gas spin gyro can improve the accuracy of Polaris submarine guidance systems by a factor of three or four.

ROYALTY-FREE PATENTS

The following inventions were developed in U. S. Government laboratories, or under U. S. Government sponsorship. All are normally available for use without charge by responsible U. S. organizations and individuals.

For Patent Number, and information on royalty-free licensing procedures write Service Department, Washington SCIENCE TRENDS, National Press Building, Washington 4, D. C.

- DECREASING CASTING POROSITY -- This patent covers a method of decreasing the porosity of castings made of iron alloy or steel through the use of sub-atmospheric pressure and a finely powdered reaction mixture.
- WATER FILTER -- This invention can be used for filtering out submicronic particles from water in industrial processing operations.
- BINARY COUNTING -- The arrangement shown in this patent is said to significantly lessen the incidence of switching transients and spurious pulses in a multi-stage digital counting chain through the use of gating techniques.
- ELECTROMAGNETIC CONTROL OF CURRENT FLOW -- In this design, a circuit functions as a switch, but without requiring physical separation of switch contacts. The switch is not a source of radio interference.
- ANTENNA RELEASE MECHANISM -- This device is designed to release an antenna for sea recovery of a missile component beacon. One end of the antenna is releasably wound on a core, and the other is attached to an explosive bellows motor which is activated by water-actuated cells.
- MAGNIFIER FOR INSTRUMENT DIALS -- This device is mounted over conventional aircraft instrument dials, and is brought into operation only for "critical" readings. The unit is said to eliminate problems of parallax errors.
- MISSILE PRIMER -- This unit uses a polarized piezoelectric element to fire an explosive charge when a missile strikes a target.
- ELECTRIC CABLE PROTECTION CHAIN -- This patent describes a chain used to suspend, raise, lower and/or tow various devices which require electrical connection between the devise and the opposite end of the chain.
- MOTOR-TRANSMISSION SYSTEM -- This patent describes a system in which a small operating force effects the clutching and declutching of gears which are capable of transmitting a relatively large torque. The system is said to provide for a variety of motions, by means of which two distinct objects (such as the control surfaces of an airplane) may be moved independently of one another or in an interrelated manner.
- HYDROSTATIC LUBRICATING APPARATUS -- This apparatus, according to the inventors, can be used in a power drive for training gun or launcher mounts with improved performance -- particularly when tracking high-speed targets. The device provides a pressurized fluid which is fed through the pistons of a positive displacement machine to lubricate pads as they rotate against a ring.
- EXPLOSIVE OPERATED VALVE -- This valve opens instantly, and remains open, for the passage of gas, water or other fluids under very high pressure.
- SERVO RELAY -- This relay device controls a servo motor for rotating a gun turret, torpedo motor or other device which must be reversed in direction of travel.

PUBLICATION CHECKLIST

- MOLYBDENUM TECHNOLOGY, a review of developments in the metallurgy of molybdenum and molybdenum-base alloys over the period June 30 to September 30, 1961. 3 Pages. Single copies free to Government agencies, their contractors, subconstractors and suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio regarding DMIC Memorandum No. 129)

- AUTOMATIC CHARACTER RECOGNITION, a state-of-the-art review prepared by the National Bureau of Standards pointing up a number of "paradoxes" in research and applications in this relatively new field. Includes a list of some 549 surveys, progress summaries, patents and technical papers. 161 Pages. $3. (Order PB 161 613 from OTS, U. S. Department of Commerce, Washington 25, D. C.

- COMMERCIAL APPLICATIONS OF SPACE COMMUNICATIONS SYSTEMS, a thoughtful Congressional report on the problems of owning and operating various types of satellite communication networks. 29 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for Report Serial O)

- ATOMIC ENERGY OCCUPATIONS, a U. S. employment Service study of many factors relating to specific jobs in industrial and technical fields which use heat and radiation resulting from nuclear fission. 57 Pages. 25 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. regarding Publication No. L 7.61:E-197)

- HELICOPTER TECHNICIAN HANDBOOK, one of a series of Air Force on-the-job-training courses covering supervision, security, safety, inspection, supply, troubleshooting and repair for the H-19, H-21 and H-23 helicopters. 118 Pages. $1.75. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. regarding "Helicopter Technician", Publication 18x)

- FM DEMODULATORS, a technical paper describing FM demodulators with negative feedback which provided performance superior to that of conventional FM receivers in the Project Echo satellite communication program. 8 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, Code ETD, Washington 25, D. C. regarding NASA Technical Note D-1134)

- AEC RAW MATERIALS PROGRAM, a report to Congress from the Atomic Energy Commission on the programs for uranium and other raw materials as of August, 1961. Single Copies Free. (Write Mr. James T. Ramey, Executive Director, Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D. C.)

- ERGONOMICS IN INDUSTRY, the Proceedings of a 1960 conference in London, England on Ergonomics -- fitting the job to the worker, or man-machine design. $2.25. (Write British Information Services, Rockefeller Plaza, New York, N. Y. regarding "Proceedings of Conference on Ergonomics in Industry.")

- MODELS FOR FIRE RESEARCH, the newly-published proceedings of a 1959 international symposium on basic and applied fire research, including studies of the interplay between aerodynamics,heat transfer and chemical reaction rates. 321 Pages. $5. (Order from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C.)

- RUSSIAN TRANSLATIONS, a list of "Russian Serials Being Translated into English and Other Western Languages" including related information. 28 Pages. Single Copies Free. (Write Science and Technology Division, Library of Congress, Washington 25, D. C.)

- ASTRONOMICAL PHENOMENA FOR THE YEAR 1964, presents data on eclipses, rising and setting of the sun and moon and other astronomical data for 1964. 44 Pages. 25 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication No. D 213.8/3:964)